SURFACE MODIFICATION OF POLYESTER FABRICS BY GRAFTING pH/THERMO-RESPONSIVE MICROGELS WITH UV-IRRADIATION

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This study investigates the surface modification of polyester (PET) fabrics by grafting dually pH- and thermo-responsive microgels using UV irradiation. The surface-modification proposed aims at polyester fabrics with enhanced hydrophilicity which could be controlled by ambient pH and temperature.

Two types of microgels were tested; one of poly(*N*-isopropylacrylamide-*co*-acrylic acid) (P(NIPAAm-AA)) microparticles, and another in the form of polyelectrolyte complexes between the aforementioned P(NIPAAm-AA) microparticles (negatively charged) and chitosan (CS, positively charged). Microgel grafting onto PET surface was performed by first treating the fabrics with benzophenone as photoinitiator, then immersing them in freshly prepared aqueous microgel dispersion and subsequently irradiating them at 254 nm for 30 min. The outcome of the proposed surface-modification technique was investigated by Scanning Electron Microscopy (SEM), X-ray Photoelectron Spectroscopy (XPS), Liquid Porosimetry, and Reflectance Spectroscopy in order to determine the surface morphology, the surface chemical composition, the pore volume distribution (PVD), and the whiteness of the modified PET, respectively.

The SEM analysis confirmed the presence of microparticles on PET fibre surfaces even after five washing cycles with a nonionic-surfactant solution (5 g/L Tanaterge EP 5071 and 2 g/L Na_2CO_3 at a 50:1 liquor-to-goods ratio) at 60°C for 30 min each. XPS revealed the presence of nitrogen atoms on the modified PET attributed to the amide groups of PNIPAAm and the amine groups of CS. XPS also showed an increase in the double-bonded oxygen signal, attributed to the amide groups of PNIPAAm and the carbonyl groups of AA. The PVD measurements showed that the porosity of the fabrics remained practically unaffected by the presence of the microparticles. Finally, measurements with the reflectance spectrophotometer showed that the modified PET fabrics have lower whiteness values (CIE index) than the reference fabric, reaching a 13.5% decrease when chitosan is present in the grafted microgel.

Wettability measurements with water as a wetting medium (pH 6.2) showed that the grafted microgels lower significantly the wetting times of PET fabrics. Finally, preliminary data of water vapour permeability measurements showed that at 20°C and 65% relative humidity the modified PET fabrics have enhanced water vapour transfer compared to the reference fabric. Further investigations are under way to explore the responsiveness of the modified polyester to pH and temperature changes, with possible applications in the field of biomedicine and technical textile materials.